

Effects of air gap on membrane substrate properties and membrane performance for biomass processing

Elfira Anuar, Syed Mohd Saufi†, and Hafizuddin Wan Yussof

Faculty of Chemical and Natural Resources Engineering, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Pahang, Malaysia

ABSTRACT

We studied a correlation between the membrane substrate properties and the final performance of hollow fiber thin film composite (TFC) membrane for xylose/glucose concentration and acetic acid removal. Polysulfone (PSf) hollow fiber membrane substrate was fabricated using 20 wt% PSf, 2 wt% polyvinylpyrrolidone and 78 wt% dimethylformamide via dry-wet spinning process. The air gap distance was manipulated from 6 cm to 15 cm during spinning to produce different substrate membrane properties. The molecular weight cut-off (MWCO) and porosity of the membrane substrate increased as the air gap distance increased. Membrane substrate that was spun at 6 cm air gap showed a rapid phase inversion without much chain relaxation, thus producing the smallest MWCO (8 kDa) and an average pore diameter (4.46 nm). The TFC membrane produced using this membrane substrate showed the best performance in terms of solute rejection and separation factor. The rejection for xylose, glucose and acetic acid was $91.66 \pm 0.09\%$, $67.28 \pm 13.97\%$, and $13.08 \pm 3.00\%$, respectively. This results in an ideal separation factor of 3.20 ± 1.27 for acetic acid/glucose and 10.42 ± 0.25 for acetic acid/xylose.

KEYWORDS

Biorefinery, Sugar Separation, Hollow Fiber, Air Gap, Thin Film Composite Membrane

DOI: <https://doi.org/10.1007/s11814-019-0289-8>

FUNDING INFORMATION

The authors would like to thank the Ministry of Higher Education Malaysia and Universiti Malaysia Pahang for the financial support provided under the Fundamental Research Grant Scheme (RDU170117-FRGS/1/2017/TK02/UMP/02/8) and Research University Grant Scheme (UMP-RDU150316), respectively.